L097125C007 - LAKE
N. Chicago Refiners + Smelters
SF/HRS

CERCLA Expanded Site Inspection Report

Illinois Environmental Protection Agency

2200 Churchill Road
P. O. Box 19276
Springfield, IL 62794-9276

APPENDICES

APPENDIX A ..... Site 4-Mile Radius Map

APPENDIX B ..... 15-Mile Surface Water Route Map

APPENDIX C ..... Target Compound List

APPENDIX D ..... IEPA Site Sampling Photographs

APPENDIX E ..... NCRS Screening Site Inspection Sample Summary

APPENDIX F ..... Vacant Lot Integrated Assessment Sample Summary

APPENDIX G ..... Boring Logs

APPENDIX H ..... NCRS Expanded Site Inspection Analytical Data

LIST OF FIGURES

FIGURE 2-1 ..... Illinois State Map

FIGURE 2-2 ..... Vicinity Map

FIGURE 2-3 ..... Plat of Vulcan-Louisville Smelting Co. Property

FIGURE 2-4 ..... NCRS Facility

FIGURE 3-1 ..... Approximate Sample Locations

LIST OF TABLES

TABLE 3-1 ..... Soil Sample Descriptions

TABLE 3-2 ..... Sediment Sample Descriptions

TABLE 3-3 ..... Soil Sample Data

TABLE 3-4 ..... Tentatively Identified Cmpds. - Soil Samples

TABLE 3-5 ..... Sediment Sample Data

TABLE 3-6 ..... Tentatively Identified Cmpds. - Sediment Samples

TABLE 3-7 ..... Provincial Sediment Quality Guidelines

TABLE 3-8 ..... Key Soil Samples

TABLE 3-9 ..... Key Sediment Samples

TABLE OF CONTENTS

Section		Page
1.	INTRODUCTION	1
2.	SITE BACKGROUND	
	2.1 INTRODUCTION	4
	2.2 SITE HISTORY	4
	2.2.1 VACANT LOT	7
	2.2.2 FANSTEEL	10
	2.2.3 N. CHICAGO REFINERS & SMELTERS. RHAUN & SONS	10
	2.3 APPLICABILITY OF OTHER STATUTES	13
3.	SITE ACTIVITIES AND ANALTYICAL RESULTS	
	3.1 INTRODUCTION	16
	3.2 SITE RECONNAISSANCE	16
	3.3 SITE REPRESENTATIVE INTERVIEW	18
	3.4 SOIL SAMPLING	19
	3.5 SEDIMENT SAMPLING	22
	3.6 ANALYTICAL RESULTS	25
	3.6.1 SOIL SAMPLES	25
	3.6.2 SEDIMENT SAMPLES	29
	3.7 KEY SAMPLES	30
4.	CHARACTERIZATION OF SOURCES	
	4.1 INTRODUCTION	39
	4.2 SOUTHEAST SURFACE IMPOUNDMENT	39
	4.3 SOUTHWEST SURFACE IMPOUNDMENT	40
	4.4 NORTH SURFACE IMPOUNDMENT	41
	4.5 TAILINGS PILE	42
	4.6 CONTAMINATED SOIL	44
	4.7 EXCAVATED SOIL PILE	44
	4.8 POTENTIAL SOURCE	45
5.	DISCUSSION OF MIGRATION PATHWAYS	
	5.1 INTRODUCTION	46
	5.2 GROUNDWATER	46
	5.3 SURFACE WATER	49
	5.4 SOIL EXPOSURE	54
	5.5 AIR	55
6.	BIBLIOGRAPHY	57

1. INTRODUCTION

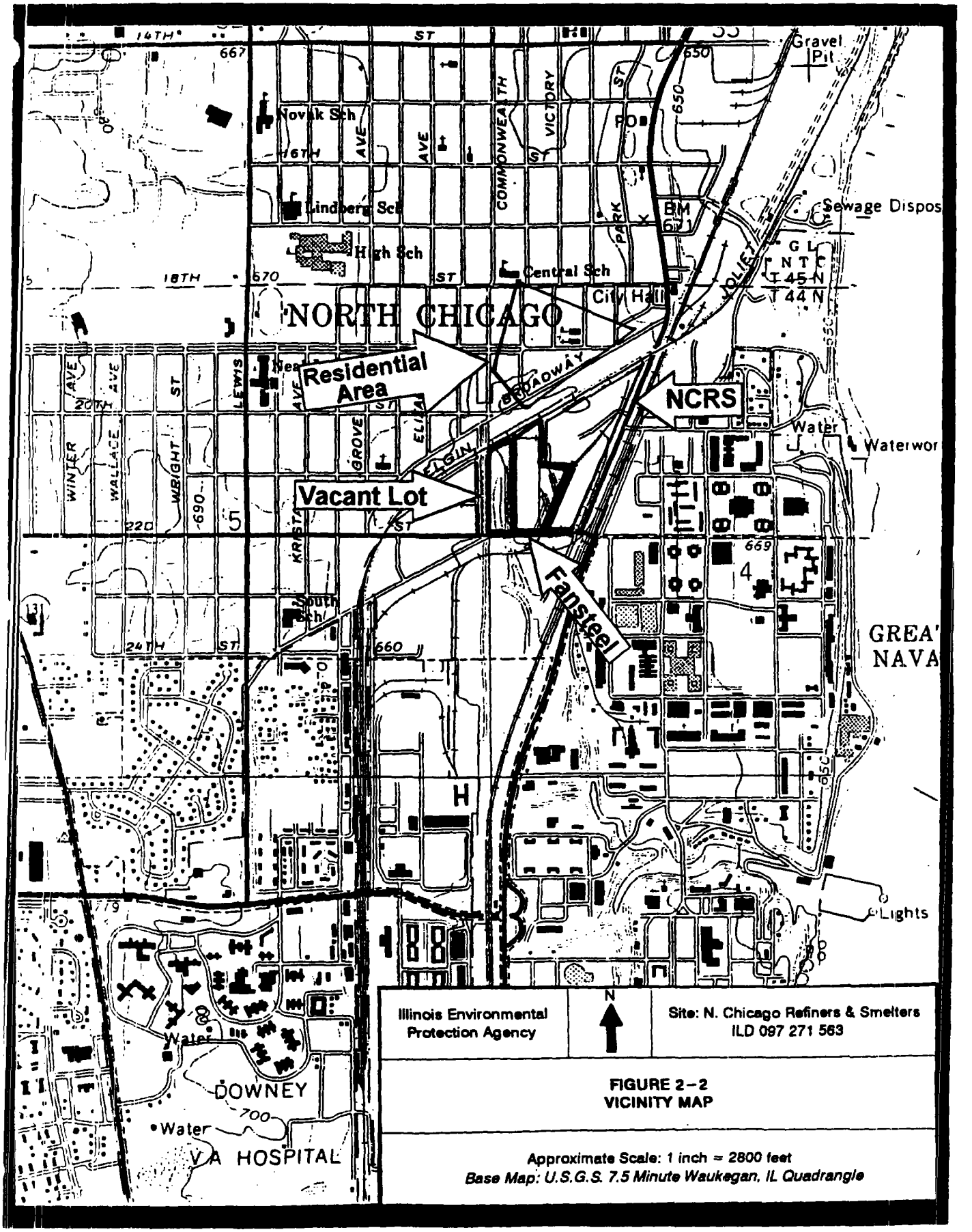
On September 22, 1993 the Illinois Environmental Protection Agency's (IEPA) Site Assessment Program was tasked by the United States Environmental Protection Agency (U.S. EPA) to conduct a CERCLA Expanded Site Inspection of the North Chicago Refiners & Smelters site in Lake County Illinois.

The site was added to CERCLIS (Comprehensive Environmental Response, Compensation and Liability System) by the Illinois EPA in August 1990 as a result of non-compliance of Resource Conservation and Recovery Act (RCRA) regulations by the facility. The non-compliance issue arose when the owner/operator insisted that the facility was not a transporter, generator or storage facility of hazardous waste and therefore could not be regulated under RCRA.

The site received its initial CERCLA evaluation in the form of a CERCLA Preliminary Assessment (PA). This assessment was performed by the Illinois EPA and was submitted to U.S. EPA in September 1991. In November 1991 the IEPA's Site Assessment Program conducted a CERCLA Screening Site Inspection of the site. In conducting this inspection eighteen soil/sediment samples were collected.

Illinois Environmental Protection Agency	Site: N. Chicago Refiners & Smelters ILD 097 271 563

FIGURE 2-1
Illinois State Map


NORTH CHICAGO
Residential Area
NCRS
Vacant Lot
Fansteel
Novak Sch
Lindberg Sch
High Sch
Central Sch
City Hall
Gravel Pit
Sewage Dispos
Water
Waterwor
South Sch
DOWNEY
Water
Water
V A HOSPITAL
GREA
NAVA
Lights
14TH ST
16TH
18TH
20TH
24TH ST
COMMONWEALTH
VICTORY
PARK
JOLIET
BROADWAY
ELGIN
LEWIS AVE
GROVE
ELIA
KRASTA
WINTER
WALLACE
WRIGHT
667
670
690
650
660
669
700
T 45 N
T 44 N
Illinois Environmental Protection Agency
N
Site: N. Chicago Refiners & Smelters
ILD 097 271 563
FIGURE 2-2
VICINITY MAP
Approximate Scale: 1 inch = 2800 feet
Base Map: U.S.G.S. 7.5 Minute Waukegan, IL Quadrangle

The purposes of the CERCLA Expanded Site Inspection have been stated by U.S. EPA in a directive outlining CERCLA site assessment program strategies. The directive states:

> The objective of the Expanded Site Inspection (ESI) is to provide documentation for preparing the Hazard Ranking System (HRS) package to support National Priority List (NPL) rulemaking. Remaining HRS information requirements are addressed and site hypotheses not completely supported during previous investigations are evaluated. Expanded SI sampling is designed to satisfy HRS data requirements by documenting observed releases, observed contamination, and levels of actual contamination at targets. In addition, investigations collect remaining non-sampling information. Sampling during the ESI includes background and quality assurance/quality control samples to fully document releases and attribute them to the site. Following the ESI, information collected and analytical results will be assembled into a report. U.S. EPA site assessment managers review the ESI report and assign the site a priority for HRS package preparation and proposal to the NPL.

In the past the CERCLA site assessment program has addressed the vacant lot site (ILD984775437), the Fansteel site (ILD005130786), and the North Chicago Refiners & Smelters site individually. However, these sites would be better assessed as one site for the following reasons:

1) Historic information shows that these sites at one time were all owned by Vulcan-Louisville Smelting and were utilized for smelting operations.
2) These sites are adjacent to one another.
3) The sites all have the same target populations.

Because the site is defined primarily by the operating area of Vulcan-Louisville Smelting it may be appropriate to change the

name of the site from North Chicago Refiners & Smelters to Vulcan-Louisville Smelting.

U.S. EPA Region V offices have requested that the Illinois EPA identify sites that may require a CERCLA removal action to remediate an immediate threat to human health and/or the environment. During the field investigation portion of the expanded site inspection a number of environmental samples were collected. Analysis of these samples showed that concentrations of three contaminants fall within or exceed the range of Removal Action Levels (RALs). The U.S. EPA CERCLA Removal Program received site data and is awaiting a health consultation, prepared by the Illinois Department of Public Health (as a contractor for the Agency for Toxic Substances and Disease Registry). Ms. Cindy Nolan of the U.S. EPA CERCLA Removal Program conducted site assessment activities at the vacant lot site in 1994. The results of this site assessment are not yet available.

2. SITE BACKGROUND

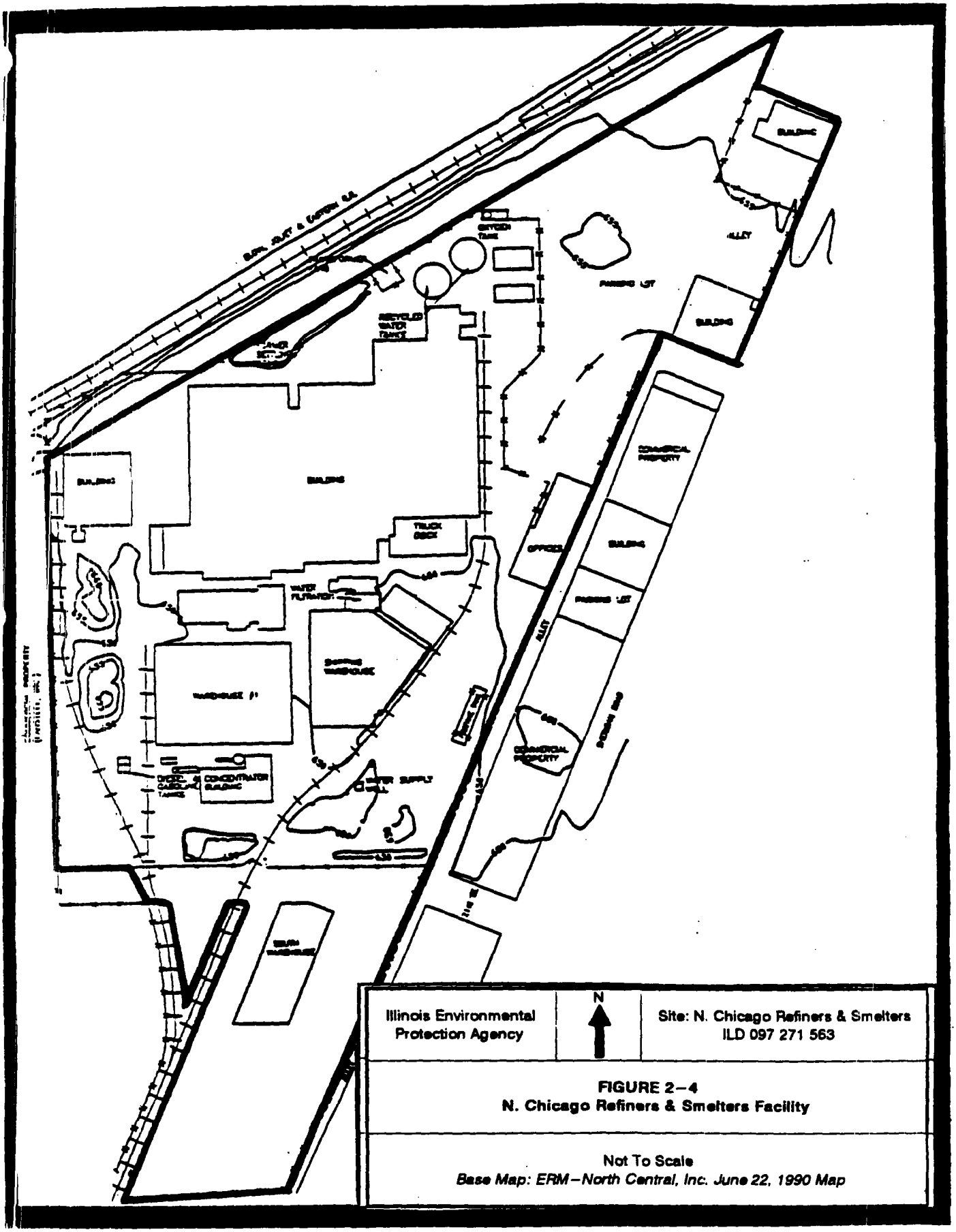
2.1 Introduction

The North Chicago Refiners & Smelters (NCRS) site is located in the city of North Chicago, in Lake County Illinois (see Figure 2-1). Based on the location of sources and areas of contamination resulting from both past and present operations, the site consists of the current NCRS facility, the property west of the facility (vacant lot and Fansteel) extending to Commonwealth Road, and a portion of the residential area located north-northwest of the NCRS facility. Figure 2-2 outlines these areas.

2.2 Site History

Historical maps reveal that the property located south of the Elgin Joliet & Eastern Railroad, north of Martin Luther King Jr. Drive, east of Commonwealth and west of Sheridan Road has been parceled many times and there have been numerous owners since the early 1900s.

Historic records show that non-ferrous smelting and refining operations have occurred at the site since the late 1800s. According to the publication "North Chicago, The First 50 Years", Lanyon Zinc Oxide Co. was one of the first factories in the town and erected their factory in 1892. The company produced from 150 to 175 barrels of zinc oxide per day. In 1905 Vulcan-Louisville Smelting Co. took over the facility and operated until 1925. A 1907 Lake County plat book shows Vulcan Smelting and Refining


Illinois Environmental Protection Agency
N
Site: N. Chicago Refiners & Smelters
ILD 097 271 563
FIGURE 2–4
N. Chicago Refiners & Smelters Facility
Not To Scale
Base Map: ERM–North Central, Inc. June 22, 1990 Map

occupying most of the present NCRS location with Nicholas Martin owning the 15.27 acres to the west where Fansteel and the vacant lot are currently located. A plat map dated 1921 (Figure 2-3) shows that the Vulcan-Louisville Smelting Company bought and/or utilized the Martin property extending their facility west to the C&NS Electric Railway (which ran north-south where Commonwealth Avenue is now located). Operations at that time appear to have occurred in the northeast portion of the property (where NCRS is now located), while the property to the west (currently the vacant lot and Fansteel) is identified as Vulcan-Louisville Smelting Co. Farm Land. A tailings pile is depicted on the "farm land". According to "North Chicago, The First 50 Years", in 1925 the Vulcan Ingot Metal Company leased the property and operated until August 1941. During this period the property was divided into three parcels: the western-most parcel being the current vacant lot, the eastern-most being the current NCRS property, and the middle parcel being the current Fansteel property. The development of each parcel is addressed below.

2.2.1. VACANT LOT

Information gathered from various plat maps, Sanborn maps, and local residents indicates that Vulcan-Louisville Smelting owned the property at the corner of Commonwealth and Martin Luther King Drive, known as the vacant lot, as late as 1929. The property was transferred to C.N.S.&M. (Chicago, North Shore and Milwaukee) Railroad Company by 1936. The railroad ran along what is now Commonwealth Avenue. Sometime between 1936 and 1954 this

property was sold to an individual who developed it as a parking lot. During this period the owner solicited for fill material to be brought to the lot. It is not known what type of fill material was accepted. Local residents have indicated that slag material from a nearby foundry was deposited at the site. Currently the title to the property is held by Northern Trust Bank in Lake Forest, Illinois as the trustee for John Stack.

CERCLA investigations at this site include a 1990 preliminary assessment, and a 1993 integrated assessment. According to a representative of Northern Trust, the bank has hired a consultant to conduct an additional environmental assessment of the vacant lot, including installation of additional monitor wells. The results of this assessment are not currently known.

Pettibone Creek, which originates just north of the Elgin Joliet & Eastern tracks, runs through the vacant lot from north to south. Surface runoff from the vacant lot enters the creek either directly, or from Martin Luther King Jr. Drive, which borders the lot to the south.

Borings taken from the property in 1989 reveal the presence of fill material consisting of black coarse sand. An IEPA Emergency Response Unit incident log indicates that the "area was filled in years ago with what appears to be materials similar to fly ash, foundry sand". The Lake County Soil Survey classifies the entire site area as "made land".

2.2.2. FANSTEEL

Lake County tax records reveal that around 1941 the western portion of the remaining Vulcan-Louisville Smelting property was transferred to the Tantalum Defense Corporation, a subsidiary of Fansteel. According to the book $2500 AND A DREAM (the history of Fansteel, Inc.), the Fansteel facility dates back to 1942 when the U.S. Government authorized and financed its construction, which was actually an expansion of the already-existing Fansteel facility located south of 22nd Street (now Martin Luther King Jr. Drive). The new facility was to utilize upgraded and mechanized equipment for the production of tantalum. According to Jack Beyrer, Fansteel's Environmental Consultant, the facility continued operations, producing tantalum mill products and forming non-ferrous metals, until November of 1990 when production at the facility ceased. The facility remains as the company's corporate headquarters.

Surface runoff from the Fansteel property flows south to MLKJ Drive where it enters a stormwater outfall and discharges to Pettibone Creek.

2.2.3. N. Chicago Refiners & Smelters

In 1941 R. Lavin & Sons (a division of North Chicago Refiners & Smelters) assumed all leases on the remaining property and engaged in the smelting and refining of non-ferrous scrap metals and manufacture of brass and bronze ingot. N. Chicago Refiners & Smelters continues to operate at the same location, 2028 Sheridan

Road in the city of North Chicago. The facility occupies approximately 18 acres that is bordered to the north by the Elgin Joliet & Eastern Railroad, to the south by Martin Luther King Jr. Drive (22nd St.) and to the east by commercial property along Sheridan Road (see Figure 2-2 and Figure 2-4). To the west of the facility is the Fansteel, Inc. office building.

According to Dennis Caldwell of NCRS, the NCRS facility processes mainly scrap brass. Operations are carried out in the northern and western portion of the property, which is relatively flat with a slight grade toward the south. Surface water run-off from the operating portion of the site flows into one of two interconnected surface impoundments on the south end of the operating area. Water is discharged from the southeast impoundment into a storm sewer tributary of Pettibone Creek.

Much of the operational portion of the facility is paved. Prominent site features include a slag pile, two active interconnected surface impoundments, a process building, warehouses and an office building.

The southern-most portion of the facility is occupied by a warehouse and water storage tank. According to the 1921 Vulcan-Louisville Smelting plat map, this area was not part of their smelting facility.

Borings taken from the facility in 1989 show a layer of fill material consisting of clayey, silty foundry sand, slag, gravel, and fragments of wood, rope, and brick from the surface to depths of 3.5 feet to 8 feet.

2.3 Applicability Of Other Statutes

The North Chicago Refiners & Smelters facility is regulated by the IEPA Bureau Of Land Pollution Control, Bureau of Water Pollution Control and Bureau Of Air Pollution Control.

Within the Bureau of Land, the NCRS facility is regulated by the Resource Conservation and Recovery Act (RCRA), the regulated waste being comprised of the fill material covering the site. Although the RCRA data base lists NCRS as a disposal facility, Hernando Alberracin of the IEPA, who oversees RCRA activities at the facility, believes that it is not a transfer, storage or disposal facility because NCRS did not generate the regulated waste. Rather, the facility is considered a land disposal facility and will be subject to RCRA corrective action during post-closure. In the past, RCRA involvement was limited due to NCRS' position that the company did not transport, generate or store hazardous waste. However, a Consent Order was implemented in October, 1990, and the company began working with the IEPA's RCRA Permit Section to address certain environmental concerns within the boundaries of the facility in order to comply with RCRA regulations. The Consent Order required that the site complete closure by July 1, 1996. According to the IEPA RCRA

Section, closure activities involve paving most areas of the site and monitoring groundwater. The closure plan was approved originally in February 1993, with modifications occurring thereafter.

The NCRS facility is also regulated by the IEPA Bureau of Water Pollution Control. In the past the facility had an NPDES permit to discharge from two outlets into Pettibone Creek. The permit expired in 1990, and a new permit was drafted. However, the new permit was not issued because NCRS appealed to the Pollution Control Board.

In 1973 the NCRS facility began receiving construction and operating permits for air emission control equipment from the IEPA's Bureau of Air. Currently the facility holds seven operating permits.

According to Agency records, the Fansteel facility filed a RCRA Part-A permit in 1980 and subsequently applied for the RCRA Part-B permit. The facility operated under interim status until January of 1991 when the RCRA Part-B application was withdrawn. The facility went through closure of its hazardous waste management unit, a waste oil storage area.

During its operational years, the Fansteel facility was also subject to Bureau of Water Pollution Control and Bureau of Air Pollution Control regulations.

The remainder of the site, consisting of the vacant lot and residential area, is not subject to environmental regulations, as they are not active facilities. Based on currently available information, no portion of the site falls under the jurisdiction of the Atomic Energy Act (AEA), the Uranium Mill Tailings Radiation Control Act (UMTRCA) or the Federal Insecticide, Fungicide or Rodenticide Act (FIFRA).

3. SITE ACTIVITIES AND ANALYTICAL RESULTS

3.1 Introduction

As part of the CERCLA Expanded Site Inspection, the Illinois Environmental Protection Agency (IEPA) collected ten sediment samples from Pettibone Creek and two of its tributaries, nine surface soil samples from the residential area north of the EJ&E RR., and two background surface soil samples. In addition, five surface soil samples were collected from the residential area during the CERCLA Integrated Assessment of the Vacant Lot site.

3.2 Site Reconnaissance

Because the NCRS facility and its onsite sources had been sampled and identified during the CERCLA Screening Site Inspection, the intent of the expanded site inspection was to identify areas around the facility that may have been affected by facility operations. To these ends, the areas around the facility and the migration pathways were visited by Judy Triller and Brad Taylor of the IEPA in April of 1994. This visit consisted of a visual inspection to identify potential sampling points in the residential area to the north of the facility and along Pettibone Creek. Also, health and safety concerns associated with the site were identified at this time.

First, the residential area north and north-west of NCRS was surveyed to find desirable sampling locations and to verify addresses of these locations. This area consisted of mostly

single-family dwellings, although several apartment buildings were seen along Broadway Avenue.

The Great Lakes Naval Training Center was also visited, with Ed Bickel of GLNTC identifying areas of interest along Pettibone Creek and the inner harbor of Lake Michigan. Many outfalls into the creek were noted. Mr. Bickel also helped locate areas at the GLNTC that corresponded to sampling locations identified on a soil survey map. After leaving the GLNTC, Mr. Bickel accompanied the IEPA personnel off-base to examine Pettibone Creek and its associated outfalls. The outfall from which NCRS discharges into the creek was identified at this time. This was later verified by telephone conversation with Chris Kallis of the Illinois Environmental Protection Agency's Maywood office. The stream was found to originate near Commonwealth Avenue, just north of the EJ&E Railroad, continue flowing south through the vacant lot, cross under Martin Luther King Jr. Drive and a parking area, and then resurface north of Sheridan Road. The creek flows below Sheridan Road, resurfaces on the GLNTC property, and continues flowing south and east through the naval training center until it enters Lake Michigan.

On March 9, 1995 Judy Triller, along with Chris Kallis, visited the R. Lavin & Sons facility at 2028 Sheridan Road. Site representatives George Lennon, Dennis Caldwell, and Raymond Reott were also present. During this visit, site operations and facility features were observed. Some changes since the time of

the CERCLA Screening Site Inspection were noted. According to the site representatives, the southeast impoundment had been dredged and lined in 1994, and rip-rap was installed around both impoundments. Also, additional areas of the site were paved, including the location of the north surface impoundment. At the vacant lot site temporary fencing had been installed along the southern boundary.

3.3 Site Representative Interview

On March 23, 1994 a letter was sent by the Illinois EPA to Mr. Bennet Lavin, President of North Chicago Refiners and Smelters, as notification of the planned CERCLA sampling activities. During subsequent correspondence with Robert Denby, Attorney for NCRS, it was explained to Mr. Denby that the sampling would focus on the residential area north of the facility and on Pettibone Creek, and no samples would be collected from the NCRS facility itself. Mr. Denby expressed concern as to why the Agency intended to collect these samples, since according to the CERCLA Screening Site Inspection samples from the residential area were not in excess of any established health-based benchmarks. Mr. Denby also expressed an interest in splitting samples.

In later correspondence with George Lennon of NCRS it was agreed that a NCRS representative would accompany the IEPA sampling team during sample collection and would split samples. Mr. Lennon was also sent a copy of the Target Compound List.

3.4 Soil Sampling

As part of the CERCLA Expanded Site Inspection, the IEPA sampling team collected nine surface soil samples (X103 - X111) from the residential area north-northwest of the NCRS facility, and two background soil samples (X101 and X102) for comparison purposes. Figure 3-1 shows the approximate sample locations. Sample X103 was collected from the Marjorie P. Hart School located at the corner of 18th and Jackson Streets, while the other samples X104 - X111 were collected from residential lawns. Table 3-1 gives the location, appearance, and depth of each soil sample. Samples X103 - X111 were each collected from a point within 200 feet of the respective residence/school. At each sample location, any vegetation was first removed, and then soil was collected with a stainless steel trowel from the top 1 inch. The sample material was transferred directly from the trowel into sample jars provided by the IEPA's Contract Laboratory Program. Dennis Caldwell of NCRS did not split these surface soil samples.

According to the Lake County Soil Survey, the residential samples, X103 - X111, and the background samples, X101 and X102, were collected from silt loam soils. The background samples were collected approximately 1.5 miles southwest of the site, from the Great Lakes Naval Training Center.

The sample jars were packaged and sealed in accordance with standard IEPA Site Assessment Program procedures. The coolers containing jars to be analyzed for inorganic parameters were

delivered to the IEPA's Organic Laboratory in Champaign, Illinois, while those coolers containing jars to be analyzed for organic parameters were delivered to the IEPA's Organic Laboratory in Springfield, Illinois. All analytical results were reviewed by the Illinois EPA Division of Laboratories, Quality Assurance Section. Photographs of the sampling activities are provided in Appendix D.

Standard IEPA equipment decontamination procedures were carried out at the IEPA decontamination facility prior to the collection of all samples and again after use. These procedures include the scrubbing of all equipment with liquid alconox and hot water, rinsing with warm tap water, rinsing with an acetone and water solution, rinsing with warm tap water again, and finally rinsing with distilled water. All trowels and the auger were air dried, then wrapped and stored in heavy-duty aluminum foil for transport to the field.

3.5 Sediment Sampling

On April 26, 1995 the IEPA sampling team collected a total of ten sediment samples from nine locations. Figure 3-1 shows approximate sample locations, and Table 3-2 gives the appearance, location, and depth of the sediment samples. Collection of sediment began in the inner harbor of Lake Michigan and proceeded upstream. The two background samples, X201 and X202 were collected from tributaries of Pettibone Creek located on GLNTC property. X201 was collected from the northern tributary, and

X202 was collected from the southern tributary of Pettibone Creek. Sample X203 was collected from the inner harbor of Lake Michigan. Samples X204 and X205 were duplicate samples collected from Pettibone Creek on GLNTC property between the harbor and the southern tributary. Sample material was placed in a stainless steel pan and mixed prior to placement in jars. Sample X206 was collected from the creek at the GLNTC between the northern and southern tributaries. Sample X207 was collected from Pettibone Creek on GLNTC near the point where the creek enters the training center. Sample X208 was collected from Pettibone Creek upstream of Sheridan Road, and downstream of the outfall from which NCRS discharges into the creek. Sample X209 was collected from the creek upstream of the NCRS outfall. Sample X110 was collected near the origin of Pettibone Creek just south of the EJ&E Railroad, near Commonwealth Avenue.

All sediment samples, except X203, were collected with a stainless steel trowel. Sample X203, from the harbor, was collected with an auger. Sample material was transferred directly from the trowel/auger into sample jars provided by the IEPA's Contract Laboratory Program.

The sample jars were packaged and sealed in accordance with standard IEPA Site Assessment Program procedures. The coolers containing jars to be analyzed for inorganic parameters were delivered to the IEPA's Organic Laboratory in Champaign, Illinois, while those coolers containing jars to be analyzed for

DATA QUALIFIERS

QUALIFIER	DEFINITION ORGANICS	DEFINITION INORGANICS
U	Compound was tested for but not detected. The sample quantitation limit must be corrected for dilution and for percent moisture. For soil samples subjected to GPC clean-up procedures, the CRQL is also multiplied by two, to account for the fact that only half of the extract is recovered.	Analyte was analyzed for but not detected.
J	Estimated value. Used when estimating a concentration for tentatively identified compounds (TICS) where a 1:1 response is assumed or when the mass spectral data indicate the presence of a compound that meets the identification criteria and the result is less than the sample quantitation limit but greater than zero. Used in data validation when the quality control data indicate that a value may not be accurate.	Estimated value. Used in data validation when the quality control data indicate that a value may not be accurate.
C	This flag applies to pesticide results where the identification is confirmed by GC/MS.	Method qualifier indicates analysis by the Manual Spectrophotometric method.
B	Analyte was found in the associated blank as well as in the sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.	The reported value is less than the CRDL but greater than the instrument detection limit (IDL).
D	Identifies all compounds identified in an analysis at a secondary dilution factor. If a sample or extract is re-analyzed at a higher dilution factor as in the "E" flag, the "DL" suffix is appended to the sample number on the Form I for the diluted sample, and all concentration values are flagged with the "D" flag.	Not used.
E	Identifies compounds whose concentrations exceed the calibration range for that specific analysis. All extracts containing compounds exceeding the calibration range must be diluted and analyzed again. If the dilution of the extract causes any compounds identified in the first analysis to be below the calibration range in the second analysis, then the results of both analyses must be reported on separate Forms I. The Form I for the diluted sample must have the "DL" suffix appended to the sample number.	The reported value is estimated because of the presence of interference.
A	This flag indicates that a TIC is a suspected aldol concentration product formed by the reaction of the solvents used to process the sample in the laboratory.	Method qualifier indicates analysis by Flame Atomic Absorption (AA).
M	Not used.	Duplicate injection (a QC parameter not met).

N	Not used	Spiked sample (a QC parameter not met).
S	Not used.	The reported value was determined by the Method of Standard Additions (MSA).
W	Not used.	Post digestion spike for Furnace AA analysis (a QC parameter) is out of control limits of 85% to 115% recovery, while sample absorbance is less than 50% of spike absorbance.
*	Not used.	Duplicate analysis (a QC parameter not within control limits).
+	Not used.	Correlation coefficient for MSA (a QC parameter) is less than 0.995.
P	Not used.	Method qualifier indicates analysis by ICP (Inductively Coupled Plasma) Spectroscopy.
CV	Not used.	Method qualifier indicates analysis by Cold Vapor AA.
AV	Not used.	Method qualifier indicates analysis by Automated Cold Vapor AA.
AS	Not used.	Method qualifier indicates analysis by Semi-Automated Cold Spectrophotometry.
T	Not used.	Method qualifier indicates Titrimetric analysis.
NR	The analyte was not required to be analyzed.	The analyte was not required to be analyzed.
R	Rejected data. The QC parameters indicate that the data is not usable for any purpose.	Rejected data. The QC parameters indicate that the data is not usable for any purpose.

TABLE 3-7

NORTH CHICAGO REFINERS & SMELTERS
ILD097271563

Provincial Sediment Quality Guidelines
(values in ug/g (ppm) dry weight unless otherwise noted)

COMPOUND	No Effect Level	Lowest Effect Level	Severe Effect Level
Cadmium	–	0.6	10
Chromium	–	26	110
Copper	–	16	110
Lead	–	31	250
Manganese	–	460	1100
Mercury	–	0.2	2
Nickel	–	16	75
Zinc	–	120	820
PCB 1016	–	(0.007)	–
PCB 1254	–	(0.06)	–
PCB 1260	–	(0.005)	–
PCB (total)	0.01	0.07	–

Values were taken from "Guidelines For The Protection And Management Of Aquatic Sediment Quality In Ontario"

– denotes insufficient data
( ) denotes tenative guidelines

organic parameters were delivered to the IEPA's Organic Laboratory in Springfield, Illinois. All analytic results were reviewed by the Illinois EPA Division of Laboratories, Quality Assurance Section. Photographs of the sampling activities are provided in Appendix D.

Standard IEPA equipment decontamination procedures were carried out at the IEPA decontamination facility prior to the collection of all samples and again after use. These procedures include the scrubbing of all equipment with liquid alconox and hot water, rinsing with warm tap water, rinsing with an acetone and water solution, rinsing with warm tap water again, and finally rinsing with distilled water. All trowels and the auger were air dried, then wrapped and stored in heavy-duty aluminum foil for transport to the field.

3.6 Analytical Results

3.6.1. Soil Samples

Ten soil samples were collected from nine locations. See Figure 3-1 for approximate sample locations and Table 3-1 for description of each sample. Contaminants detected in soil samples include volatile and semivolatile organic compounds, pesticides, PCBs, and inorganic compounds. See Table 3-3 and Table 3-4 for complete soil sample results.

Three compounds, arsenic, lead, and chromium, were at concentrations exceeding or within CERCLA Removal Action Level

ranges. Two compounds have been found to exceed the health-based bench marks identified in the Superfund Chemical Data Matrix - benzo(a)pyrene (during the 1993 CERCLA Integrated Assessment of the Vacant Lot site) and PCBs (during the 1994 CERCLA Expanded Site Inspection of NCRS). Information currently available does not indicate that the PCBs are attributable to smelting or refining operations at the site. One possibility is that the facility may have burned wires to reclaim copper, producing PCBs in air emissions. Appendix F contains a sample summary of samples collected during the CERCLA Integrated Assessment of the Vacant Lot site and Appendix E contains a sample summary of samples collected during the CERCLA Screening Site Inspection of NCRS.

3.6.2 Sediment Samples

A total of seven sediment samples were collected from Pettibone Creek, with two background samples collected from tributaries to the creek. One sediment sample was collected from the inner harbor of Lake Michigan. Figure 3-1 shows the approximate location of sediment samples, while Table 3-2 provides a description of sediment samples.

Analyses of the sediment samples revealed the presence of volatile and semivolatile organic compounds, pesticides, polychlorinated biphenyls (PCBs), metals and other inorganic compounds. These compounds were detected throughout Pettibone Creek, and in the harbor of Lake Michigan. Many of the volatile

compounds detected in the surface water pathway have not been detected in samples collected at either the vacant lot or at the NCRS facility. Table 3-5 and Table 3-6 summarize the analyses of the sediment samples. The validated laboratory data package can be found in Appendix H of this report.

Comparing the sediment sample results to the Guidelines For The Protection And Management Of Aquatic Sediment Quality In Ontario, copper, lead, manganese, nickel and zinc were found at concentrations greater than the "Severe Effect Level". Arsenic, cadmium, chromium, copper, lead, manganese, mercury, nickel, PCBs and zinc were found in some samples at concentrations between the "Lowest Effect Level" and the "Severe Effect Level". Table 3-7 lists the Ontario guideline concentrations of concern.

3.7 Key Samples

Key samples are samples in which contaminants are attributable to the site and are detected at three times the concentration found in the appropriate background sample (or at levels exceeding the detection limit when the analyte is not detected in the background sample).

Table 3-8 (Key Sediment Samples) and Table 3-9 (Key Soil Samples) identify those samples collected during the expanded site inspection that meet these criteria. Seven sediment sample locations and eight soil sample locations were found to meet the key sample criteria.

TABLE 3-3
NORTH CHICAGO REFINERS & SMELTERS
ILD097271563

SOIL SAMPLES

SAMPLING POINT	X101 GLNTC Background 4-27-94	X102 GLNTC Background 4-27-94	X103 School 4-27-94	X104 Resid. 4-27-94	X105 Resid. 4-27-94	X106 Resid. 4-27-94	X107 Resid. 4-27-94	X108 Resid. 4-27-94	X109 Resid. 4-27-94	X110 Resid. 4-27-94	X111 Resid. 4-27-94
VOLATILES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
Methylene Chloride	4.00 J	12.00 U	--	--	--	--	7.00 J	--	--	--	--
1,1,1-Trichloroethane	3.00 J	12.00 U	--	--	--	--	6.00 J	--	--	--	4.00 J
SEMIVOLATILES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
2-Methylnaphthalene	390.00 U	390.00 U	--	--	110.00 J	--	--	--	--	--	--
Acenaphthylene	390.00 U	390.00 U	--	--	170.00 J	170.00 J	--	--	--	--	--
2,6-Dinitrotoluene	390.00 U	390.00 U	--	--	--	--	--	--	--	--	--
Phenanthrene	420.00	250.00 J	--	--	--	480.00	510.00	170.00 J	190.00 J	690.00	190.00 J
Anthracene	390.00 U	390.00 U	89.00 J	--	90.00 J	--	--	--	--	150.00 J	--
Carbazole	390.00 U	390.00 U	89.00 J	--	--	--	--	--	--	94.00 J	--
Di-n-Butylphthalate	1100.00	390.00 U	--	400.00	--	830.00	1200.00 B	1500.00	--	830.00	1100.00
Fluoranthene	590.00	610.00	390.00	130.00 J	250.00 J	760.00	630.00	310.00 J	300.00 J	1300.00	380.00 J
Pyrene	520.00	490.00	250.00 J	130.00 J	350.00 J	940.00	710.00	240.00 J	280.00 J	1600.00	340.00 J
Butylbenzylphthalate	390.00 U	390.00 U	--	--	--	--	--	--	--	130.00 J	--
3,3'-Dichlorobenzidine	390.00 U	390.00 U	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	400.00	430.00	--	--	--	640.00	480.00	140.00 J	190.00 J	1100.00	220.00 J
Chrysene	470.00	480.00	850.00	500.00	1100.00	810.00	540.00	190.00 J	240.00 J	1200.00	270.00 J
bis(2-Ethylhexyl)phthalate	150.00 J	390.00 U	--	--	--	530.00	570.00	590.00	610.00	--	280.00 J
Di-n-Octylphthalate	390.00 U	390.00 U	--	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	460.00	390.00 U	--	--	--	--	520.00	--	--	1100.00	230.00 J
Benzo(k)fluoranthene	370.00 J	490.00	820.00	450.00	790.00	800.00	440.00	170.00 J	210.00 J	--	200.00 J
Benzo(a)pyrene	380.00 J	320.00 J	570.00	310.00 J	670.00	620.00	--	--	--	800.00	180.00 J
Indeno(1,2,3-cd)pyrene	200.00 J	390.00 U	--	--	--	--	--	--	--	--	--

TAF -3 (continued)
NORTH CHIC/ .EFINERS & SMELTERS
ILD097271563

SOIL SAMPLES

SAMPLING POINT	X101 GLNTC Background 4-27-94	X102 GLNTC Background 4-27-94	X103 School 4-27-94	X104 Resid. 4-27-94	X105 Resid. 4-27-94	X106 Resid. 4-27-94	X107 Resid. 4-27-94	X108 Resid. 4-27-94	X109 Resid. 4-27-94	X110 Resid. 4-27-94	X111 Resid. 4-27-94
PESTICIDES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
delta-BHC	20.00 U	2.00 U	--	--	--	3.90 P	--	280.00 PD	280.00 PD	--	--
gamma-BHC (Lindane)	20.00 U	2.00 U	--	0.79 JP	0.29 JP	1.40 JP	--	--	--	--	--
Heptachlor	20.00 U	2.00 U	--	--	--	--	--	150.00	150.00	3.30 P	--
Heptachlor epoxide	20.00 U	2.00 U	2.10 P	7.20 P	--	--	--	1000.00 PD	1000.00 PD	5.90 P	--
Dieldrin	20.00 U	0.76 JP	1.90 JP	5.40 P	--	25.00 P	2.90 JP	--	--	--	43.00 PD
4,4'-DDE	2600.00 BC	35.00	--	500.00 D	80.00	65.00 D	31.00	150.00	150.00	32.00	--
Endrin	4.10 JP	4.80 P	10.00 P	22.00 P	26.00 P	86.00 D	39.00	--	--	30.00	180.00 D
Endosulfan II	38.00 U	2.60 J	--	--	11.00 P	--	11.00	--	--	--	--
4,4'-DDD	28.00 JP	4.80 P	1.90 JP	54.00 D	11.00 P	41.00 PD	6.20 P	--	--	7.40 P	7.60 P
Endosulfan sulfate	38.00 U	3.90 U	--	--	--	--	--	20.00 JP	14.00 JP	--	--
4,4'-DDT	590.00 BC	22.00	22.00	430.00 D	89.00	120.00 PD	38.00 P	130.00 P	140.00 P	41.00 P	18.00 P
Methoxychlor (Mariate)	58.00 J	20.00 U	--	--	--	--	--	--	--	--	14.00 JP
Endrin Ketone	38.00 U	3.90 U	--	--	--	--	--	--	--	--	--
Endrin aldehyde	8.70 JP	3.90 U	--	--	--	--	7.70 P	14.00 JP	13.00 JP	--	--
alpha-Chlorodane	4.40 JP	0.44 JP	8.60	23.00 P	8.00 P	55.00 D	4.80 P	4100.00 D	4100.00 D	40.00 P	50.00 D
gamma-Chlorodane	20.00 U	1.50 JP	4.80 P	9.70 P	6.50 P	20.00 P	4.80 P	2000.00 PD	1900.00 PD	--	48.00 PD
Toxaphene	2000.00 U	200.00 U	--	--	--	--	--	--	--	--	--
Aroclor-1016	380.00 U	39.00 U	--	--	--	650.00 D	--	--	--	--	--
Aroclor-1254	--	--	--	--	--	--	--	--	--	--	2100.00 D
Aroclor-1260	380.00 U	39.00 U	91.00	200.00 P	220.00	640.00 D	260.00	320.00 JP	370.00 JP	230.00	1300.00 D
INORGANICS	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	15400.00	13700.00	14900.00	12700.00	16700.00	15500.00	14700.00	16000.00	16800.00	13300.00	16000.00
Antimony	10.20 UJ	10.10 UJ	--	--	--	--	--	--	--	--	--
Arsenic	7.60	9.10	6.20	12.60	11.10	10.60	13.10	10.00	11.40	12.10 J	9.10 J
Barium	72.20	63.00	91.90	136.00	116.00	135.00	129.00	151.00	159.00	103.00	101.00
Beryllium	0.81 B	0.75 B	0.84 B	1.10	1.50	1.00 B	1.10	1.00 B	1.00 B	0.97 B	1.00 B
Cadmium	0.80 U	0.79 U	--	5.50	5.30	3.00	5.70	4.60	3.40	2.61	1.40
Calcium	16100.00	26200.00	18300.00	16300.00	25500.00	11000.00	12100.00	12300.00	12500.00	18100.00	12400.00
Chromium	23.40	21.60	23.00	36.10	34.70	216.00	75.80	45.90	45.00	62.40	33.30
Cobalt	8.10 B	9.00 B	7.20 B	7.40 B	9.50 B	10.60	8.50 B	9.80 B	10.40 B	12.70	9.00 B
Copper	24.40	22.70	60.20	506.00	606.00	200.00	370.00	300.00	287.00	281.00	271.00
Iron	22900.00	21700.00	20100.00	23300.00	25500.00	24400.00	22100.00	21700.00	22800.00	22300.00	22600.00
Lead	47.70	38.70	132.00	1180.00	586.00	297.00	467.00	251.00	233.00	318.00	200.00
Magnesium	10600.00	17500.00	10800.00	8900.00	11400.00	2740.00	6610.00	7240.00	7400.00	10400.00	7070.00
Manganese	700.00	689.00	539.00	404.00	542.00	470.00	553.00	782.00	814.00	709.00	412.00
Mercury	0.05 B	0.06 B	0.15	0.43	0.47	0.58	3.80	0.23	0.26	0.43	0.13
Nickel	23.80	26.70	22.60	34.80	44.60	32.20	30.70	27.70	24.30	31.70	26.60
Potassium	3250.00	2670.00	2630.00	1940.00	2280.00	2680.00	2080.00	2230.00	2150.00	2110.00	2600.00
Selenium	0.23 UJ	0.24 UJ	0.29 BJ	1.50 J	1.60 J	0.50 BJ	2.10 J	0.43 BJ	2.00 J	2.30 J	0.34 BJ
Silver	0.80 U	0.79 U	--	1.00 B	--	2.40	9.80	1.10 B	1.20 B	--	--
Sodium	89.40 B	115.00 B	119.00 B	121.00 B	252.00 B	114.00 B	120.00 B	98.80 B	108.00 B	110.00 B	87.40 B
Thallium	0.23 UJ	0.24 UJ	--	--	--	--	--	--	0.52 B	0.44 B	0.45 B
Vanadium	37.00	32.00	35.10	33.80	35.30	35.40	35.60	36.70	38.70	31.90	36.80
Zinc	91.80	86.30	329.00	2650.00	2690.00	761.00	1740.00	1210.00	1150.00	1100.00	845.00
Cyanide	0.98 U	0.98 U	--	--	1.40	2.10	--	1.40	--	--	--

TABLE 3-4

North Chicago Refiners & Smelters
ILD097271563

TENTATIVELY IDENTIFIED COMPOUNDS – SOIL SAMPLES

SAMPLE POINT	X102	X103	X104	X105	X108	X109
Benzenedicarboxylic acid	2000 BJN	2200 JN	1800 JN	2300 JN	N.D.	1600 J
Heptachlor Epoxide	N.D.	N.D.	N.D.	N.D.	490 JN	550 JN
Methyl Phenanthrene	N.D.	N.D.	N.D.	840 JN	N.D.	N.D.

TABLE

NORTH CHICAGO REFINERS & SMELTERS
ILD097271563

SEDIMENT SAMPLES

SAMPLING POINT	X201 Trib. to Pettibone Baackground	X202 Trib. to Pettibone Background	X203 L. Michigan Harbor	X204 Pettibone GLNTC	X205 Dup. of X204	X206 Pettibone GLNTC	X207 Pettibone GLNTC	X208 Pettibone	X209 Pettibone	X210 Pettibone
Date	4-26-94	4-26-94	4-26-94	4-26-94	4-26-94	4-26-94	4-26-94	4-26-94	4-26-94	4-26-94
VOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
Vinyl Chloride	14.0 U	14.0 U	--	--	--	--	--	--	30.0	670.0 D
Methylene Chloride	14.00 U	14.0 U	35.0 B	--	--	--	--	--	--	--
Acetone	23.0	12.0 J	26.0	16.0	24.0 J	7.0 J	46.0 J	5.0 J	5.0 J	--
Carbon Disulfide	4.0 J	14.0 U			4.0 J	4.0 J	4.0 J	--	--	--
1,1-Dichloroethene	14.0 U	14.0 U	--	--	--	--	--	--	--	8.0 J
1,1-Dichloroethane	14.0 U	14.0 U	--	--	--	--	--	--	--	12.0 J
1,2-Dichloroethene (total)	14.0 U	14.0 U				--	34.0	25.0	25.0	700.0 D
2-Butanone	13.0 J	5.0 J	20.0	7.0 J	6.0 J	--	31.0 J	--	--	--
1,1,1-Trichloroethane	14.00 U	14.0 U	13.0	--	--	--	--	--	--	--
Trichloroethene	14.00 U	14.0 U	--	--	--	--	13.0 J	8.0 J	--	4.0 J
4-Methyl-2-Pentanone	14.00 U	14.0 U	--	--	--	--	3.0 J	--	--	--
Tetrachloroethene	14.00 U	14.0 U	--	--	--	--	21.0	--	--	--
1,1,2,2-Tetrachloroethane	14.00 U	14.0 U	--	--	--	--	4.0 J	--	--	--
Toluene	14.00 U	14.0 U	4.0 J	--	--	--	12.0 J	--	--	--
Ethylbenzene	14.00 U	14.0 U	--	--	--	--	6.0 J	--	--	--
Styrene	14.00 U	14.0 U	--	--	--	--	3.0 J	--	--	--
Xylene (total)	14.00 U	14.0 U	6.0 J	--	--	--	33.0	--	--	--
SEMIVOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
4-Methylphenol	450.00 U	440.0 U	--	--	--	--	820.0 J	--	--	--
Naphthalene	130.00 J	170.0 J	600.0	--	--	300.0 J	--	--	--	--
2-Methylnaphthalene	110.00 J	160.0 J	310.0 J	--	--	120.0 J	--	--	93.0 J	--
Acenaphthylene	450.00 U	120.0 J	--	--	--	--	--	--	--	--
Acenaphthene	730.00	440.0 U	850.0	--	--	530.0	--	--	--	--
Dibenzofuran	510.00	130.0 J	600.0	--	--	330.0 J	--	--	--	--
Fluorene	680.00	220.0 J	980.0	--	--	--	--	--	--	--
Phenanthrene	45000.00 U	1100.0	5700.0	3100.0	3100.0	4800.0	5000.0	--	130.0 J	420.0
Anthracene	840.00	220.0 J	1200.0	--	--	670.0	--	--	--	--
Carbazole	950.00	220.0 J	1500.0	--	--	1200.0	--	--	--	--
Di-n-Butylphthalate	740.00	960.0	980.0 B	1100.0 J	1300.0 J	--	1100.0 J	--	--	--
Fluoranthene	3100.00	1600.0	2000.0	3000.0	3100.0	7200.0	6700.0	--	--	750.0
Pyrene	45000.00 U	1400.0	1100.0	2400.0	2800.0	6100.0	4600.0	--	--	730.0
Butylbenzylphthalate	420.00 J	440.0 U	--	--	--	--	--	--	--	--
Benzo(a)anthracene	2200.00	880.0	--	1700.0 J	--	3400.0	2700.0	--	--	410.0
Chrysene	2300.00	870.0	3800.0	--	--	3500.0 J	3300.0	--	--	490.0
bis(2-Ethylhexyl)phthalate	300000.00	560.0	--	--	--	12000.0	22000.0	--	--	440.0
Di-n-Octylphthalate	23000.00 J	440.0 U	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	450.00 U	730.0	--	--	--	--	4300.0	--	--	--
Benzo(k)fluoranthene	2300.00	440.0 U	3500.0	--	--	--	2800.0	--	--	--
Benzo(a)pyrene	450.00 U	440.0 U	2500.0	--	--	2100.0	3200.0	--	--	--

TABLE 3-5 (cont'd)

NORTH CHICAGO REFINERS & SMELTERS
ILD007271563

SEDIMENT SAMPLES

SAMPLING POINT	X201 Trib. to Pettibone Baackground	X202 Trib. to Pettibone Background	X203 L. Michigan Harbor	X204 Pettibone GLNTC	X205 Dup. of X204	X206 Pettibone GLNTC	X207 Pettibone GLNTC	X208 Pettibone	X209 Pettibone	X210 Pettibone
Date	4-26-94	4-26-94	4-26-94	4-26-94	4-26-94	4-26-94	4-26-94	4-26-94	4-26-94	4-26-94
PESTICIDES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
alpha-BHC	2.30 U	1.2 J	5.5 P	--	--	6.0 P	--	--	--	--
delta-BHC	2.30 U	2.3 U	--	120.0 P	--	--	--	--	--	--
Heptachlor	1.30 J	2.3 U	--	--	--	--	--	--	--	--
Heptachlor epoxide	2.30 U	4.0 P	--	--	--	--	--	--	--	--
Endosulfan I	2.30 U	2.3 U	--	--	30.0	--	--	--	--	--
Dieldrin	4.80 P	9.8 P	12.0 P	36.0 JP	25.0 JP	64.0 PD	5.8 P	--	--	0.6 JP
4,4'-DDE	4.50 U	41.0	280.0 D	230.0 P	260.0 P	300.0 D	--	--	--	--
Endrin	33.00 P	9.7 P	82.0 PD	210.0 P	210.0 P	220.0 PD	53.0 P	0.4 JP	0.7 JP	6.0 P
Endosulfan II	12.00	4.4 U	--	--	--	--	17.0	--	--	--
4,4'-DDD	26.00 P	59.0	580.0 D	3300.0 D	3100.0 D	460.0 PD	53.0 P	--	--	5.7 P
4,4'-DDT	42.00	71.0	200.0 D	170.0	310.0	170.0 PD	69.0 P	0.5 JP	0.7 JP	--
Endrin aldehyde	4.50 U	4.4 U	--	96.0 P	--	--	--	0.2 JP	--	6.1 P
alpha-Chlorodane	1.10 JP	29.0	19.0	84.0	--	16.0	12.0 P	--	--	2.4
gamma-Chlorodane	2.30 U	16.0 P	21.0 P	36.0 P	30.0 P	--	8.5 P	--	--	1.7 JP
Aroclor-1016	45.00 U	44.0 U	--	1300.0	1600.0	680.0 P	--	--	12.0 J	--
Aroclor-1254	270.00	44.0 U	1200.0 PD	5200.0 PD	3300.0 P	1800.0 D	650.0	--	--	69.0
Aroclor-1260	310.00	160.0	--	1400.0	1700.0	2800.0 D	460.0	10.0 J	11.0 JP	--
INORGANICS	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	4320.00	3740.0	4180.0	11600.0	12400.0	4830.0	4450.0	12800.0	16000.0	10100.0
Antimony	14.70 UJ	10.8 UJ	--	15.5 J	--	--	--	--	--	--
Arsenic	5.90 J	6.1 J	8.8 J	22.1	24.0	7.4	7.4 J	17.5 J	7.1 J	8.5 J
Barium	54.90 B	55.2	31.6 B	208.0	167.0	48.8	50.4 B	104.0	68.6	96.1
Beryllium	0.46 B	0.3 B	0.8 B	2.4	3.0	0.6 B	0.7 B	11.2	1.3	0.9 B
Cadmium	1.20 U	0.8 U	0.9 B	4.7	5.6	0.9 B	2.3	1.5	--	--
Calcium	47800.00	65000.0	39700.0	88700.0	102000.0	53700.0	31800.0	85700.0	76000.0	83800.0
Chromium	9.70	13.0	12.9	61.6	69.2	21.6	20.8	42.2	25.3	17.0
Cobalt	7.10 B	6.9 B	6.0 B	18.1	15.4	5.0 B	4.1 B	13.5	11.5	8.1 B
Copper	38.20	16.9	159.0	465.0	475.0	209.0	425.0	2530.0	106.0	69.8
Iron	11600.00	16000.0	12000.0	19000.0	17300.0	15000.0	12100.0	36700.0	23700.0	19300.0
Lead	146.00	48.0	149.0	392.0	435.0	278.0	167.0	1840.0	46.9	48.2
Magnesium	23700.00	36400.0	20500.0	24600.0	29800.0	28700.0	15700.0	38500.0	39500.0	44300.0
Manganese	345.00	472.0	342.0	2140.0	2470.0	378.0	291.0	1110.0	541.0	616.0
Mercury	0.04 B	0.1 B	0.2	1.4	1.6	0.3	0.1 B	0.2	1.1	--
Nickel	9.20 B	10.4	24.9	216.0	445.0	22.9	19.4	107.0	36.1	26.1
Potassium	836.00 B	1060.0	885.0 B	3350.0	3290.0	1190.0	636.0 B	1680.0	4700.0	2660.0
Selenium	0.27 UJ	0.2 UJ	--	3.5 J	5.0 J	0.7 BJ	--	2.2 J	--	--
Silver	1.20 U	0.8 U	1.5 B	42.1	50.8	1.8 B	--	--	--	--
Sodium	292.00 B	227.0 B	463.0 B	765.0 B	748.0 B	273.0 B	548.0 B	5540.0	700.0 B	658.0 B
Thallium	0.27 U	0.2 U	--	--	0.4 BJ	--	--	0.2 B	0.5 B	0.3 B
Vanadium	15.00	13.8	14.2	25.6	26.9	15.1	12.5 B	22.4	29.7	21.2
Zinc	159.00	83.3	664.0	1160.0	605.0	685.0	1230.0	17000.0	614.0	820.0
Cyanide	1.20 U	1.0 U	--	3.9	4.2	2.4	--	--	--	--

TABLE 3-6

North Chicago Refiners & Smelters
ILD097271563

TENTATIVELY IDENTIFIED COMPOUNDS – SEDIMENT SAMPLES

SAMPLE POINT	X201	X203	X206	X207	X208	X209
Benzenedicarboxylic acid	290000 JN	N.D.	N.D.	N.D.	1700 JN	2100 JN
Benzo(c)phenanthrene	N.D.	N.D.	1400 JN	N.D.	N.D.	N.D.
Dimethyldisulfide	N.D.	N.D.	N.D.	220 JN	N.D.	N.D.
Hydroxymethyl Pentanone	340000 JNBA	N.D.	170000 JNBA	180000 JNBA	N.D.	N.D.
Methylanthracene	N.D.	2600 JN	N.D.	N.D.	N.D.	N.D.
Naphthacene	N.D.	7000 JN	N.D.	N.D.	N.D.	N.D.
Thiobis Methane	N.D.	N.D.	N.D.	230 JN	N.D.	N.D.

TABLE 3-8
NORTH CHICAGO REFINERS & SMELTERS
ILD097271563

KEY SOIL SAMPLES

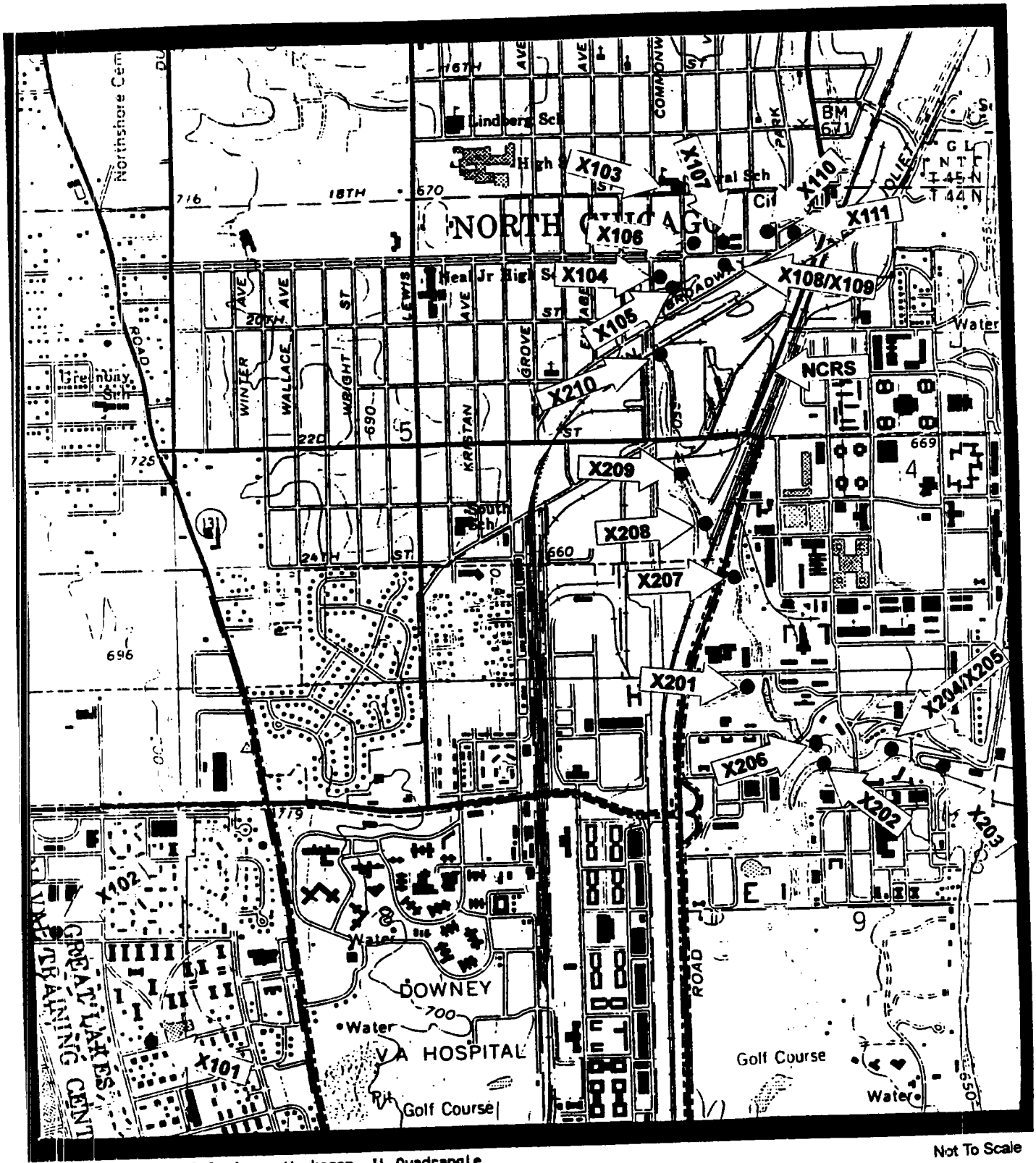
SAMPLING POINT	X101 GLNTC Background 4-27-94	X102 GLNTC Background 4-27-94	X103 School 4-27-94	X104 Resid. 4-27-94	X105 Resid. 4-27-94	X106 Resid. 4-27-94	X107 Resid. 4-27-94	X108 Resid. 4-27-94	X109 Dup. of X108 4-27-94	X110 Resid. 4-27-94	X111 Resid. 4-27-94
SEMIVOLATILES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
Di-n-Butylphthalate	1100.00	390.00 U	--	400.00	--	830.00	--	1500.00	--	830.00	--
Pyrene	520.00	490.00	--	--	--	--	--	--	--	1600.00	--
bis(2-Ethylhexyl)phthalate	150.00 J	390.00 U	--	--	--	530.00	570.00	590.00	610.00	--	--
Benzo(b)fluoranthene	460.00	390.00 U	--	--	--	--	520.00	--	--	1100.00	--
INORGANICS	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Cadmium	0.80 U	0.79 U	--	5.50	5.30	3.00	5.70	4.60	3.40	2.61	1.40
Chromium	23.40	21.60	--	--	--	216.00	75.80	--	--	--	--
Copper	24.40	22.70	--	506.00	606.00	200.00	370.00	300.00	287.00	281.00	271.00
Lead	47.70	38.70	132.00	1180.00	586.00	297.00	467.00	251.00	233.00	318.00	200.00
Silver	0.80 U	0.79 U	--	--	--	2.40	9.80	--	--	--	--
Zinc	91.80	86.30	329.00	2650.00	2690.00	761.00	1740.00	1210.00	1150.00	1100.00	845.00
Cyanide	0.98 U	0.98 U	--	--	1.40	2.10	--	1.40	--	--	--

TABLE 3-9

NORTH CHICAGO REFINERS & SMELTERS
ILD097271563

KEY SEDIMENT SAMPLES

SAMPLING POINT	X201 Trib. to Pettibone Baackground	X202 Trib. to Pettibone Background	X203 L. Michigan Harbor	X204 Pettibone GLNTC	X205 Dup. of X204	X206 Pettibone GLNTC	X207 Pettibone GLNTC	X208 Pettibone	X209 Pettibone	X210 Pettibone
Date	4-26-94	4-26-94	4-26-94	4-26-94	4-26-94	4-26-94	4-26-94	4-26-94	4-26-94	4-26-94
PESTICIDES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
Arolcor-1254	270.00	44.0 U	--	--	--	1800.0 D	--	--	--	--
Aroclor-1260	310.00	160.0	--	1400.0	1700.0	2800.0 D	--	--	--	--
INORGANICS	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Barium	54.90 B	55.2	--	208.0	167.0	--	--	--	--	--
Cadmium	1.20 U	0.8 U	--	4.7	5.6	--	2.3	1.5	--	--
Chromium	9.70	13.0	--	61.6	69.2	--	--	42.2	--	--
Copper	38.20	16.9	159.0	465.0	475.0	209.0	425.0	2530.0	--	--
Lead	146.00	48.0	--	--	--	--	--	1840.0	--	--
Manganese	345.00	472.0	--	2140.0	2470.0	--	--	--	--	--
Nickel	9.20 B	10.4	--	216.0	445.0	--	--	107.0	36.1	--
Silver	1.20 U	0.8 U	--	42.1	50.8	--	--	--	--	--
Zinc	159.00	83.3	664.0	1160.0	605.0	685.0	1230.0	17000.0	614.0	820.0



Base Map: U.S.G.S. 7.5 Minute Waukegan, IL Quadrangle

FIGURE 3-1

APPROXIMATE SAMPLE LOCATIONS

North Chicago Refiners & Smelters

N
W E
S

TABLE 3-1

NORTH CHICAGO REFINERS & SMELTERS
ILD097271563

SOIL SAMPLE DESCRIPTIONS

SAMPLE	DEPTH	APPEARANCE	APPROXIMATE LOCATION
X101	0" – 1"	Light brown silt loam	GLNTC; Lawn of housing unit 2845. 42' S of south side of housing unit 2845 and 93' W of Wisconsin Street
X102	0" – 1"	Light brown silty loam with some gravel and clay, black lumps	GLNTC; Baseball field, lawn area north of Wyoming St. 114' N of Wyoming St. and 50' W of utility pole B280
X103	0" – 1"	Light brown silty loam	M.P. Hart School; 1110 18th Street. East of building and south of playground 27' S of playground fence and 30.5' E of east side of school building
X104	0" – 1"	Dark brown silt loam with some sand	1923 Glenn; off SW corner of house; 18' S of southwest corner of house and 25' E of fence along Glenn
X105	0" – 1"	Dark brown humus with some clay	1924 Jackson Street; front lawn, east of house; 23' E of southeast corner of house and 15' S of home's walkway leading to front porch
X106	0" – 1"	Light brown silty loam	1018 Argonne Drive; front lawn; 12' S of southeast corner of home and 14'4" W of walk leading to front door
X107	0" – 1"	Dark brown silt loam with some sand	918 Argonne; front lawn; 16' S of home's southeast corner and 18.5' W of home's walk leading to front door
X108/X109	0" – 1"	Light brown silty loam	917 Argonne; back lawn; 15' W of residence's east wood fence and 19' S of south wall of house
X110	0" – 1"	Light brown silty loam	1630 Park Ave.; back lawn; 20' W of west side of house and 11'10" S of hurricane fence

TABLE 3-2

NORTH CHICAGO REFINERS & SMELTERS
ILD097271563

SEDIMENT SAMPLE DESCRIPTIONS

SAMPLE	DEPTH	APPEARANCE	APPROXIMATE LOCATION
X201	4" – 8" under 2" water	Black/brown; sandy to med. size gravel; leaf decay	GLNTC, northern trib. to Pettibone 138' downstream of steam line
X202	4" – 6" under 4" – 6" water	Black; sandy with leaf decay	GLNTC, southern trib. to Pettibone 274' upstream of hospital bridge
X203	6" – 16" under 2.5' water	Dark silty gravel with some sand	GLNTC, inner harbor; 160' E of bridge marked "1938" 52' N of southern concrete bank
X204/X205	16" – 18" under 18" water	Very black; sandy, silty with gravel; petroleum–like odor	GLNTC, Pettibone Crk. between harbor and southern trib. 42' S of gravel rd. and 183' W of bridge
X206	4" – 8" under 3" water	Black; sandy to lrg. rock texture; tar–like smell	GLNTC, Pettibone Crk. between the tributaries; 140' downstream of bunker 24 E
X207	0" – 6" under 1" water	Dark grey; silt/sand with leaf matter	GLNTC, Pettibone Crk. 12' downstream from culvert where creek enters GLNTC
X208	0" – 6" under 6" water	Grayish brown clay	Pettibone Crk. NW of Sheridan Rd. 15' downstream of outfall from east/north.
X209	8" – 9" under 8" water	Hard gray clay	Pettibone Crk. NW of Sheridan Rd. 34' downstream from Federal Chicago fence.
X210	0" – 6" under 4" water	Dark gray/green; silty sandy clay	Origin of Pettibone Crk. 1' downstream of culvert from north 20' east of Commonwealth

4. CHARACTERIZATION OF SOURCES

4.1 Introduction

Information obtained through CERCLA activities concerning North Chicago Refiners & Smelters and other nearby sites has led to the identification of six sources: two active surface impoundments, one backfilled surface impoundment, a tailings pile, contaminated soil, and a soil pile. Due to the limited scope of these screening activities, the possibility exists that further investigation of the site could reveal additional information that would further characterize these sources, or lead to the identification of additional sources.

4.2 Southeast Surface Impoundment

The southeast surface impoundment is located near the southeast corner of the operating portion of the NCRS property, just northeast of the south warehouse and has also been referred to as the east ditch. This impoundment receives water from on-facility storm sewers, groundwater infiltration and overflow from the process reservoir tank. The water is discharged from the impoundment into a storm water sewer tributary of Pettibone Creek. In 1994 this impoundment was dredged and lined. The sediments resulting from the dredging were put in a furnace. Rip-rap has been installed to help prevent erosion into the impoundment. In compliance with the Consent Order, the facility collects groundwater samples from six monitoring wells on a semi-annual basis.

Sediment from the southeast surface impoundment was sampled during the November 1991 Screening Site Inspection (SSI) at the NCRS facility. The results revealed the presence of cadmium, calcium, chromium, copper, lead, magnesium, nickel, silver, and zinc at concentrations at least three times above background concentrations.

The impoundment, measured by Illinois EPA Field Operations Section personnel in 1989 was 125 feet long by 11 feet wide at its widest point, for a total of 1375 square feet. Using a planimeter on a 1988 aerial photograph, the area of the impoundment was measured to be 1652 square feet.

4.3 Southwest Surface Impoundment

The southwest surface impoundment is located near the southwest corner of the operating portion of the NCRS property, just northwest of the south warehouse and has also been referred to as the west ditch. This impoundment receives surface runoff and groundwater infiltration. When the north impoundment was active, water was pumped from the southwest impoundment into the north impoundment. Currently this water is pumped into a storage tank on the south portion of the facility to be re-used and to avoid discharges from the impoundment. The southwest surface impoundment has no liner nor leachate collection system. Rip-rap has been installed to help prevent erosion. In accordance with the closure plan, the facility collects and analyzes groundwater samples from monitoring wells on a semi-monthly basis.

Sediments from the southwest surface impoundment were sampled during the November 1991 SSI at the NCRS facility. The results revealed that 2-methylnaphthalene, beryllium, calcium, chromium, copper, lead, nickel, silver, and zinc were present at levels at least three times above background concentrations.

The impoundment, measured by Illinois EPA Field Operations Section personnel in 1989, was 106 feet long by 58 feet wide at its widest point, for a total of 6,148 square feet. Using a planimeter on a 1988 aerial photograph, the area of the impoundment was measured to be 2,688 square feet.

4.4 North Surface Impoundment

The north surface impoundment, currently filled and paved, was located north of the furnace buildings and the receiving warehouse, near the north boundary of the NCRS property. This impoundment was part of the water recirculation system and was used as a settling pond for wastewater. The resulting water was then pumped through filters filled with sand and anthracite coal and reused in various areas of the plant. Occasionally the filters became clogged with sediment and automatically flushed back to this surface impoundment. This impoundment was backfilled in 1991. According to Dennis Caldwell of NCRS, most of the solid material (primarily charcoal material) was removed from the impoundment and recycled. As part of the closure plan, this area was paved. The north surface impoundment had no liner, no leachte collection system, and no groundwater monitoring

system. In accordance with the closure plan, the facility now monitors groundwater on a semi-annual basis.

The backfilled north surface impoundment was sampled during the November 1991 SSI. The results indicated that PCBs, barium, cadmium, calcium, chromium, copper, lead, magnesium, nickel, silver and zinc were present at levels at least three times the background concentration.

The impoundment, measured by Illinois EPA Field Operations Section personnel in 1989 was 215 feet long by 50 feet wide at its widest point, for a total of 10,750 square feet. Using a planimeter on a 1988 aerial photograph, the area of the impoundment was measured to be 9300 square feet.

4.5 Tailings Pile

The tailings pile is located at the corner of Commonwealth Avenue and Martin Luther King Jr. Drive, and is also referred to as the vacant lot. A 1921 plat map of the Vulcan-Louisville Smelting Co. shows that company's property extending from Sheridan Road on the east to the electric railroad (now Commonwealth Ave.) on the west. The area now occupied by the vacant lot and by Fansteel was then designated as "Vulcan-Louisville Smelting farm land", and a tailings pile is depicted in the northern portion of the "farm land". Other information collected from N. Chicago residents also indicates that a former owner of the vacant lot accepted various types of fill material. The area is covered

with tailings/cinder-like material. During the ESI a hand auger was used to bore around the perimeter of the lot to determine whether cinder material was present throughout the site. In some areas the cinder material was seen at the surface, but not found beneath. In other areas the cinder material was found deeper - at least 3 feet deep. Borings performed by MAECORP, Inc. during installation of monitoring wells also revealed black gravely, sandy fill material at various depths. In general, cinder material can be found in all areas of the lot although in some areas it is found just at the surface. In addition, a heap of cinder material, approximately 170 feet x 56 feet x 4 feet is located on the lot. The Lake County Soil Survey classifies this property as "made land".

Because the cinder-like surface material, as well as sandy fill material, is not originally part of the lot, but has apparently been deposited here, this source is considered to be a pile rather than contaminated soil.

In 1988, a fire broke out at the lot, and firefighters determined that subsurface material had become hot enough to ignite nearby brush. A 1993 CERCLA Integrated Site Inspection of the vacant lot site revealed the presence of volatiles, semivolatiles, pesticides, PCBs, and various metals.

- As measured from a 1988 aerial photograph, the size of the lot/pile is approximately 7.5 acres, but is intersected by

Pettibone Creek. Observations of the property indicate that there is no type of containment in place. No liner is visible, nor do borings from the site reveal any natural or man-made liner. The area is vegetated in some areas, while other areas are bare. Surface water runoff is not controlled in any way. Runoff from the area flows into Pettibone Creek or into the street, which drains into the creek.

4.6 Contaminated Soil

The area of contaminated soil is located in the residential area to the north of NCRS, north of the E&E RR. Samples collected from this area were found to contain contaminants at levels at least three times the background concentration.

This source was delineated by connecting peripheral sample points that established an observed release. The area between these sample points consists of approximately 25.2 acres. However, much of this area is covered with houses, garages, streets, etc.

Consisting of residential lawns, this source has no type of containment other than grass cover.

4.7 Excavated Soil Pile

During the screening site inspection a pile of excavated soil was located west of the southwest surface impoundment. The pile was the result of construction work conducted on-site to install

above-ground tanks for the process water and recirculation system.

The pile was sampled during the CERCLA Screening Site Inspection and was found to contain six inorganic compounds, chromium, copper, lead, nickel, sodium, and zinc, present at levels above background concentrations (see Appendix E).

According to a map in the August 3, 1990 Environmental Resources Management (ERM) report, the excavated soil pile is approximately 70 feet by 50 feet for a total area of 3,500 square feet. At the time of the screening site inspection the pile was located in an unpaved area and was not covered. However, during the March 1995 visit to the NCRS facility, the pile was covered.

4.8 Potential Source

During the screening site inspection of the NCRS facility, two slag piles were noted. During the reconnaissance visit of March 1995, a slag pile was also noted in the western portion of the facility. The slag is a by-product of the smelting/refining process. According to Dennis Caldwell, brass is reclaimed from the slag material. No samples were collected from the slag pile. Currently, the slag is deposited in an unpaved area and is not covered. However, as part of the closure this area is to be paved, and according to Dennis Caldwell, in the future the slag will be stored under roof.

5.DISCUSSION OF MIGRATION PATHWAYS

5.1 INTRODUCTION

The CERCLA Site Assessment Program identifies three migration pathways and one exposure pathway by which hazardous substances may pose a threat to human health and/or the environment. Consequently, sites are evaluated on their known or potential impact to these four pathways. The pathways evaluated are groundwater migration, surface water migration, soil exposure, and air migration.

This section presents and discusses information collected during the CERCLA Expanded Site Inspection of the North Chicago Refiners & Smelters site. This information, together with information documented in other sources, will be utilized in analyzing the site's impact on the four pathways and the various human and environmental targets within the established target distance limits.

Discussions of the pathways will include pathway descriptions; contaminant sources; and targets, such as human populations, fisheries, endangered species, wetlands and other sensitive environments.

5.2 GROUNDWATER

Soil borings from the site indicate that the surface geology underlying the facility consists of fill from 2 feet to 8 feet

deep. This fill consists of a black, silty, fine-grained foundry sand containing interbedded clay and limestone layers, including some gravel, cinders, wood fragments, crushed slag, rope and broken brick. According to a report by Environmental Resources Management - North Central, Inc., the natural geology of the area consists of glacial drift, primarily clay and silt, with interbedded sand and gravel deposits to a depth of approximately 160 feet. A sand and gravel deposit lies at the base of the glacial drift, and ranges in depth from 2 feet to over 20 feet. Underlying the basal sand unit, Silurian dolomite (approximately 240 feet thick) extends as deep as 400 feet below the surface. According to the report, a good hydraulic connection exists between the Silurian dolomite and overlying glacial drift. The Silurian dolomite is underlain by Maquoketa shale, Galena-Platteville dolomite, and Glenwood St-Peter sandstone.

The interconnected glacial deposits and Silurian dolomite aquifer system is considered the aquifer of concern at this site. The Maquoketa shale, acting as a confining layer, separates the glacial and dolomite deposits from the underlying dolomite and sandstone.

Although the majority of the population within 4 miles of the site obtains drinking water from lake Michigan, groundwater is also utilized for drinking. According to the Illinois EPA Division of Public Water Supplies and well data obtained from the Illinois State Water Survey, the drinking wells within four miles

drawing water from the aquifer of concern include two public water supply wells (one within 1-2 miles and one within 2-3 miles); three non-community public wells (all within 2-3 miles); and approximately 215 private wells. The nearest known drinking-water well drawing from the aquifer of concern is a private well located approximately 1.5 miles south-southeast of the site. Although other wells do exist within the 4-mile target distance limit, none of these are known to draw from the aquifer of concern. Approximate groundwater populations within each distance ring are summarized below.

Groundwater Target Populations

Distance (miles)	Private Wells	Public Wells	Non-Community Wells	Total Population
0 - 1/4	0	0	0	0
1/4 - 1/2	0	0	0	0
1/2 - 1	0	0	0	0
1 - 2	15	1	0	115
2 - 3	32	1	3	3160
3 - 4	168	0	0	1820

Population based on Lake County average of 2.97 people/household.

No sources are known to lie within a designated wellhead protection area. However, two wellhead protection areas do exist within the 4-mile target distance limit, one within 1-2 miles and the other within 2-3 miles from the site.

No groundwater samples were collected during the expanded site inspection. However, the NCRS facility does have eight shallow and three deep monitor wells. Past sampling has revealed the presence of cadmium, chromium, copper, lead, nickel and zinc. The vacant lot located at the corner of Commonwealth and Martin Luther King Jr. Drive also has three shallow monitoring wells that were sampled during the CERCLA Screening Site Inspection of that site. Groundwater samples collected from these wells revealed the presence of seven compounds exceeding the health-based benchmarks cited in the Superfund Chemical Data Matrix. These compounds are boron, chlordane, 1,1-dichloroethene, 1,2-dichloroethylene, manganese, trichloroethylene, and vinyl chloride. Each of these compounds, except 1,1-dichloroethene and vinyl chloride, was also detected in samples collected from the vacant lot surface material.

5.3 SURFACE WATER PATHWAY

Surface water runoff from the NCRS facility, from Fansteel and from the vacant lot enters Pettibone Creek, either directly or via the storm sewer system. As described previously, the stream originates near Commonwealth Avenue, just north of the E&E Railroad, and flows south through the vacant lot. Although the U.S.G.S. topographic map does not show this portion of the creek as perennial, according to a local authority, the creek normally has a constant flow at this point and so is considered perennial from its point of origin. The stream crosses under Martin Luther King Jr. Drive and a parking area, and then resurfaces for a

short distance north of Sheridan Road. It continues below Sheridan Road, resurfaces on the GLNTC property, and continues flowing south and east through the naval training center until it enters Lake Michigan. The probable point of entry into the surface water pathway is near the origin of the creek, just south of the E&E railroad tracks at the vacant lot. The total length of the creek from its probable point of entry to Lake Michigan is approximately 1.2 miles.

The watershed of Pettibone Creek consists of the city of North Chicago, and storm sewers collecting water from a large section of the city drain into the creek. According to Keith Humphries, the North Chicago Hazardous Materials Officer, due to sediment buildup in the creek, water that would normally flow down the creek through the vacant lot is diverted into the storm sewer system along Commonwealth before returning to the creek at Martin Luther King Jr. Drive. The city is considering dredging a portion of the creek to restore the natural flow of water along the creek bed.

The N. Chicago Refiners & Smelters facility has four discharge points into Pettibone Creek: 1) 001, which is discharge from the reservoir tank into the southeast impoundment; 2) 002, which is discharge from the southeast impoundment to the storm sewer tributary of Pettibone Creek; 3) 003, storm water discharge to Pettibone Creek via storm sewer system; 4) 004, another storm water discharge to Pettibone Creek via storm sewers. The

facility's NPDES (National Pollutant Discharge Elimination System) permit expired in 1990. This permit included only outfalls 001 and 002. A new permit, which includes outfalls 003 and 004, was drafted in 1990; however NCRS filed for a permit appeal to the Pollution Control Board maintaining that the facility should be subject to general storm water regulations, rather than NPDES. This issue has not been resolved.

Pettibone Creek, which according to Vernon Knapp of the Illinois State Water Survey, has a calculated average flow of less than 10 cubic feet-per-second (cfs), is not used for drinking. According to an employee of the Public Works Center of the Great Lakes naval Training Center, fish and frogs are present in the creek, and fish may swim up Pettibone Creek from Lake Michigan to spawn. Ed Bickel of the naval training center has also noted that children could play in the creek.

Lake Michigan is used for recreational purposes as well as a drinking water supply. The lake is used for swimming, and fishing is common in the inner harbor where Pettibone Creek enters the lake. Information from the IEPA bureau of Public Water Supplies and from local water operators indicates that 9 communities have intakes located within the 15-mile surface water target distance limit. Populations associated with these intakes are shown below.

INTAKE NAME	POPULATION
Zion-Benton	25,000
Waukegan	67,653
North Chicago	15,000
Great Lakes Naval Training Center	30,000
Lake Forest	15,800
Highwood	5,500
Highland Park	31,580
Northbrook	33,200
Glencoe	9,200
TOTAL	232,933

Information provided to the Agency by the Illinois Department of Conservation documents the presence of sensitive environments along the Lake Michigan shoreline within the target distance limit. Twenty different state endangered or threatened species, eight state-designated natural areas and two state-designated nature preserves are located in or adjacent to Lake Michigan within the 15-mile surface water target distance limit. There are also an estimated 15.5 miles of Lacustrine wetland frontage along the lake's shoreline and within the 15-mile target distance

limit, according to the National Wetland Inventory prepared by the U.S. Department of Interior.

According to a Federal Emergency Management Agency National Flood Insurance Rate Map, the sources at the site lie in an "area of minimal flood hazards".

No surface water samples were collected during the expanded site inspection. However, eight sediment samples were collected from seven locations along the surface water path. Also, two background sediment samples were collected for comparison purposes. Analyses of the sediment samples revealed the presence of volatile and semivolatile organic compounds, pesticides, polychlorinated biphenyls (PCBs), metals and other inorganic compounds. These compounds were detected throughout Pettibone Creek and in the harbor of Lake Michigan. Many of the volatile compounds detected in the surface water pathway have not been detected in samples collected at either the vacant lot or at the NCRS facility. Furthermore, the background samples (X201 and X202) collected from tributaries of Pettibone Creek contained elevated concentrations of several semivolatile organic compounds.

Copper, lead, manganese, nickel and zinc were found at concentrations greater than the "Severe Effect Level" listed in Guidelines For The Protection And Management of Aquatic Sediment Quality In Ontario. Arsenic, cadmium, chromium, copper, lead,

manganese, mercury, nickel, PCBs and zinc were found in some samples at concentrations between the "Lowest Effect Level" and the "Severe Effect Level".

5.4 SOIL EXPOSURE PATHWAY

Soil exposure is of concern at the vacant lot, in the residential area and at the NCRS facility. Past sampling at the vacant lot has revealed the presence volatile and semivolatile organic compounds, pesticides, PCBs, and inorganic analytes. Several of these compounds were found at concentrations that exceed the health-based benchmarks cited in the Superfund Chemical Data Matrix. The vacant lot has been used as a throughway for local foot traffic, and portions of the lot (west of the creek) have been inhabited at times. During the March 9, 1995 visit to the site, it was noted that temporary fencing was installed along the southern border of the lot.

In the residential areas, soil exposure is of concern since volatile and semivolatile organic compounds, pesticides, PCBs and inorganic compounds were detected in residential soil samples. Although the soil was taken from near the surface, most areas appear to be grass-covered, reducing the risk of exposure. According to the Illinois Department of Public Health, contaminants detected in the residential lawn samples (collected during the 1993 screening site inspection of the vacant lot) of public health concern are polynuclear aromatic hydrocarbons, lead, and manganese.

As stated previously, the U.S. EPA CERCLA Removal Program has received site data and is awaiting a health consultation, prepared by the Illinois Department of Public Health. The Removal Program has already conducted site assessment activities at the vacant lot site, though the results of this assessment are not yet available.

5.5 AIR PATHWAY

Since smelting operations have occurred at this location since before 1900, it is likely that air releases have occurred in the past. This is confirmed by analysis of samples collected from the surrounding soils, which contain elevated levels of cadmium, chromium, copper, cyanide, lead, silver, zinc and semivolatiles.

No air samples were obtained, nor were any releases documented visually. The potential does exist for windblown particulates to carry contaminants from the vacant lot, or possibly from residential areas with little vegetative cover. The NCRS facility holds seven operating permits, issued by the IEPA Bureau of Air. The table below summarizes the target populations found within each distance ring. The populations were obtained from 1990 census data for municipal areas and from a count of homes on U.S.G.S. topographic maps for the rural areas. Census data indicates a 2.97 persons-per-household average for Lake County.

DISTANCE	POPULATION
On A Source	847
Greater than 0 to 1/4 mile	700
Greater than 1/4 to 1/2 mile	3,239
Greater than 1/2 to 1 mile	15,089
Greater than 1 to 2 miles	33,031
Greater than 2 to 3 miles	24,896
Greater than 3 to 4 miles	23,635
TOTAL	101,437

National Wetland Inventory Maps, published by the U.S. Department of Interior indicate that no wetlands are present within 1/2 mile of the site.